

# Phases of the Moon

## Answer Key

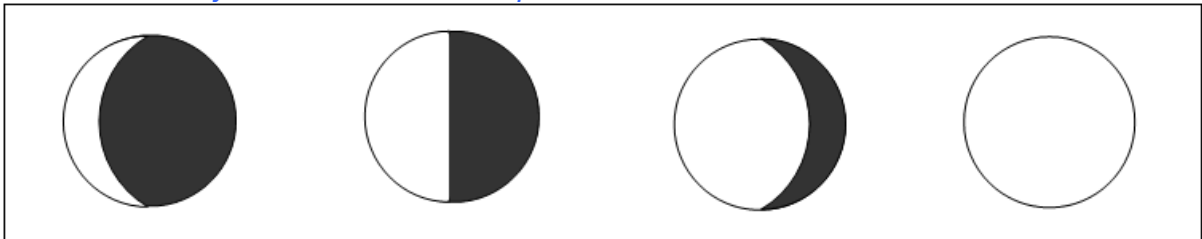
**Vocabulary:** axis, crescent, First Quarter, Full Moon, gibbous, illuminate, Moon phase, New Moon, orbit, revolve, rotate, Third Quarter, waning, waxing

**Prior Knowledge Questions** (Do these BEFORE using the Gizmo.)

*[Note: The purpose of these questions is to activate prior knowledge and get students thinking. Students are not expected to know the answers to the Prior Knowledge Questions.]*

1. A **Moon phase** is what the Moon looks like from Earth at a particular time. In the space below, draw a few pictures of different Moon phases, based on what you have seen before.

*Answers will vary. Here are some examples:*



2. About how often does a Full Moon happen? *About once a month.*

### Gizmo Warm-up

1. In the *Phases of the Moon Gizmo™*, click **Play** (▶). What do you notice about the motion of the Moon?

*The Moon goes around Earth. [Counterclockwise]*

The path that the Moon takes is called its **orbit**. The Moon is **revolving** around Earth.

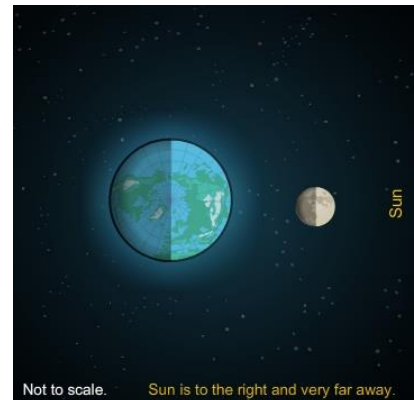
2. What do you notice about the motion of Earth?


*Earth is spinning. [Counterclockwise. Earth also is orbiting the Sun, but that is not shown.]*

This motion is called **rotation**. Earth rotates on its **axis**, a straight line connecting the North Pole to the South Pole.

3. Where would you have to be to see the view shown above? Explain.

*You would have to be in space. [The perspective is from directly over the North Pole.]*



<b>Activity A:</b> <b>Moon phases</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>Click <b>Reset</b> (↺).</li> </ul>	
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**Question: Why do we see phases of the Moon?**

1. Brainstorm: Why do you think we see phases of the Moon?

*Answers will vary as students write their conjectures here. [Students likely do not know the answer to this yet, and at this stage of the lesson that is perfectly fine. The actual reason is given in #5 below.]*

2. Run Gizmo:

- Click **Play**. As the Moon goes around Earth, notice what the Moon looks like on the right side of the Gizmo. (This shows what an observer on the North Pole would see.)
- Turn on **Show view area** to see which part of the Moon is visible from Earth.

3. Observe: How does the Moon's appearance change as the Moon revolves around Earth?

*At first the Moon is dark. Then the Moon is a thin sliver [crescent]. Then half of the Moon is lit up. Then most of the Moon is lit up. Then the Moon is full. After that the Moon is mostly lit up, then half lit up, then a thin sliver, and finally completely dark again.*

4. Analyze:

- A. Look at the overhead view of the Moon and Earth. How much of the Moon is always lit up, or **illuminated**, by the Sun? *Half of the Moon is always illuminated.*
- B. Can we always see the same amount of the illuminated side of the Moon from Earth? Explain.


*No. As the Moon orbits Earth, we see more and more of the illuminated side of the Moon until Full Moon is reached. We then see less and less of the illuminated side of the Moon until it goes back to the New Moon phase.*

5. Think and discuss: Based on your observations, why do we see Moon phases?

*Moon phases are caused by two factors:*

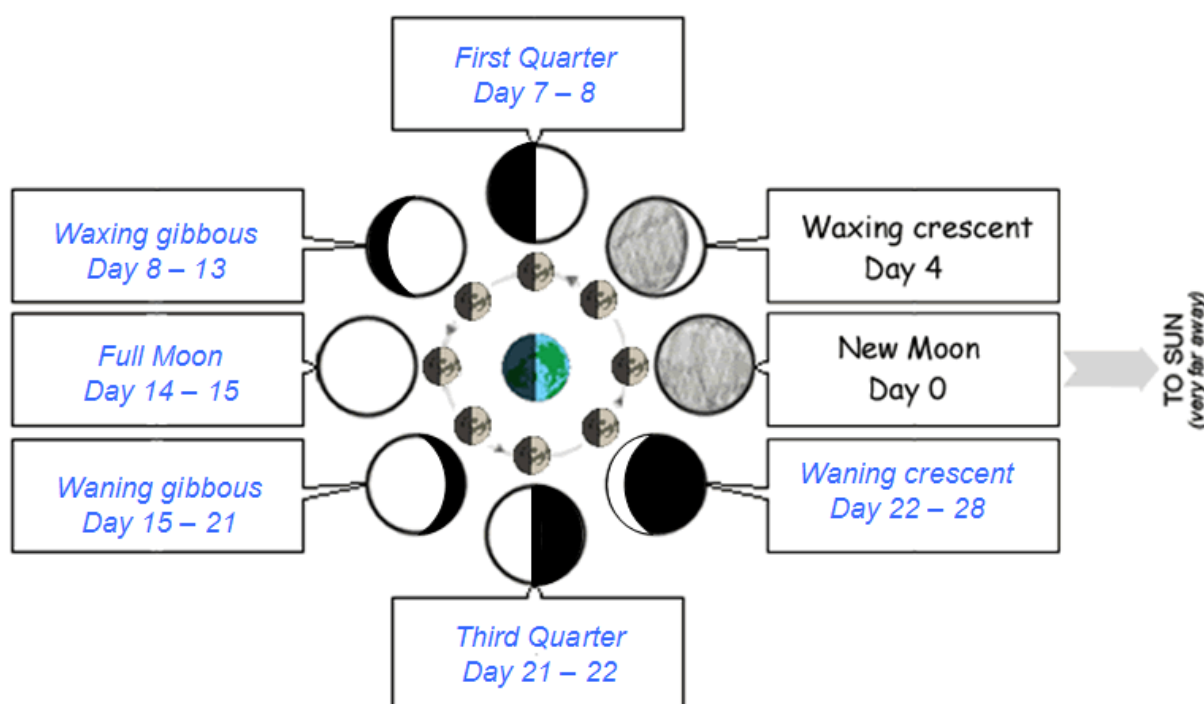
- *Half of the Moon is always illuminated by the Sun.*
- *We see more or less of the illuminated side depending on the Moon's position.*

*[Students may have trouble articulating this. Spend time discussing this important concept.]*

<b>Activity B:</b> <b>Name that phase!</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>Click <b>Reset</b>.</li> </ul>	
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**Goals: Learn the names of Moon phases and when they occur.**

1. Run Gizmo: Click **Play**. When you are ready to fill in part of the diagram, click **Pause** (⏸). Sketch what the Moon looks like and write the phase name and day next to your sketch. (The first two are done for you.) Click **Play** to continue.



2. Predict: Suppose you saw a waxing gibbous Moon. What phase would you expect one week later? *Predictions will vary. [Waning gibbous]* Test your prediction using the Gizmo.
3. Think and discuss: **Waxing** means “growing” and **waning** means “shrinking.”
  - A. Seen from the North Pole, which side of a waxing Moon is illuminated? *The right side*
  - B. Which side is illuminated when the Moon is waning? *The left side*
  - C. Suppose you see a crescent Moon. How do you know if it is waxing or waning?

*If the right side is illuminated, it is waxing. If the left side is illuminated, it is waning. [As you move from the North Pole to the Equator, the Moon will appear to “tilt” more and more. From the Southern hemisphere the left-right directions are reversed.]*

<b>Extension:</b>  <b>The Man in the Moon</b>	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> <li>• Click <b>Reset</b>.</li> <li>• Turn on <b>Show flag</b>.</li> </ul>	
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**Question:** If you look closely at the Full Moon, you may notice dark areas that look a bit like a face. This is known as “The Man in the Moon.” Does this side of the Moon always face Earth?

1. Form hypothesis: Do you think we always see the same side of the Moon?  
*Answers will vary. [The correct answer is yes, but many students will not know this yet.]*
2. Run Gizmo: Click **Play**. The flag helps you notice how quickly the Moon is rotating. Click **Pause** when the flag has rotated in a full circle, showing that the Moon has rotated once.
3. Observe: Where does the flag point as the Moon revolves around Earth? *Towards Earth.*
4. Draw conclusions: Do we always see the same side of the Moon? How do you know?  
*Yes, we always see the same side of the Moon. The Moon flag always points toward Earth.*
5. Observe:
  - A. How long did it take for the Moon to go around Earth?  
*The Moon takes about 29.5 days to go around Earth. [Actually, it takes the Moon just over 27 days to revolve a full 360°. But Earth is also moving around the Sun in this time, so the Moon has to “catch up” for two days to get back to its original position.]*
  - B. How long did it take for the flag to rotate once in a full circle?  
*The Moon also takes about 29.5 days to rotate once. [Again, in reality it takes just over 27 days, but because of Earth’s motion around the Sun it takes two extra days for the Moon to return to its original orientation relative to the Earth and Sun.]*
6. Analyze: What do you notice about these two time intervals?  
*It takes the same time for the Moon to rotate as it takes to revolve around Earth. [This explains why we always see the same side of the Moon from Earth.]*
7. Think and discuss: Suppose the Moon rotated on its axis just as quickly as Earth. Would we still always see the same side of the Moon from Earth? Explain.  
*We would see all sides of the Moon every day. [The Moon would rotate 180 degrees in 12 hours, allowing an observer to see the front and back of the Moon in that time period.]*